A Comparison of Work Force Skills and Wages Between Ontario, Canada and Selected States in the U.S.

A Research Report Prepared by

David West
Research and Policy Coordinator

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The Premier's Council on Economic Renewal

April, 1993

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Premier's Council on Economic Renewal

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The Ontario Premier's Council on Economic Renewal, chaired by the Premier, brings together leaders from business, labour, educational institutions and government to develop consensus-based solutions for achieving economic renewal and restructuring. Through task forces and special projects, the Council identifies strategic issues and assesses the need for change. It proposes and helps launch initiatives to improve the way business, labour, government and academic institutions work together to achieve economic renewal. It conducts research which involves the participation of key stakeholders in a variety of areas, including investment, lifelong learning, the organization of work, wealth creation through innovation and best business practices.

The Council also provides advice to the Premier and his government on long-range issues pertaining to economic policy development and implementation.

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It is important to emphasize that this is a report of the Council Secretariat and that the views expressed in this report are those of the authors and do not necessarily reflect the views of the Premier's Council on Economic Renewal or the Government of Ontario.

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Table of Contents

I. Executive Summary ... 1

II. Introduction ... 3

III. Competitive Advantage and Workforce Skills ... 3

IV. Measuring Workforce Skills ... 5

  i. Educational Attainment ... 6

  ii. Knowledge-Intensive Occupations ... 12

V. Educational Attainment, Knowledge-Intensive Occupations and Wages ... 17

Appendix I: Data Sources ... 25

Appendix II: Methodology ... 26

Appendix III: Data Tables ... 29

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I. Executive Summary

The Secretariat of the Ontario Premier's Council on Economic Renewal initiated the *Comparative Indicators Project* to identify and analyze economic and social indicators which would be helpful in positioning Ontario's performance within North America. This study — part of that larger project — compares the skill and quality of the Ontario work force with those of other Canadian and U.S. jurisdictions. It does so using readily available sources of information on educational attainment and occupational composition as proxies for the overall skill and quality of the work force.

In the global economy, no jurisdiction exists in isolation. In that context, there is an emerging consensus that the most important source of competitive advantage for firms within a jurisdiction is the skill and quality of that society's work force. All other competitive advantages are either less durable or more mobile.

However, while there is general agreement that human resources are the key to long-run competitive advantage, there is no agreement on how to measure this factor. Nor has there been any recent, comprehensive attempt to measure Canada or Ontario's relative performance. As noted, the work summarized in this report focuses on two widely available and broadly comparable measures of work force skills: *educational attainment and occupational mix.*

While this report focuses on comparing Ontario's relative performance within Canada and with key U.S. States with which Ontario trades and competes, some broad conclusions can be drawn for all of Canada. In future, it may be possible to extend the research to include other countries important to Ontario and Canada such as Japan, Germany and Mexico, but that is beyond the scope of the present study.

The results of this study are encouraging for both Ontario and Canada in general. On average, the work force in Canada is both better educated and has a higher proportion of knowledge-intensive occupations than most U.S. States. Moreover, average wages in Canada appear very competitive when compared to average wages in many U.S. States. Notwithstanding these positive signs, economy-wide comparisons obscure some important weaknesses of the Ontario and Canadian work forces, particularly in sectors which have long been regarded as key.

Based on measures of educational attainment and knowledge-intensive occupations, the Ontario work force compares most favourably in service sector industries such as finance, insurance, business services (including computer services), health and education and certain manufacturing industries such as chemicals and electronic products.

Ontario fares less well in those manufacturing industries commonly thought to be Ontario's strengths: transportation equipment (including motor vehicles and aircraft), machinery and primary metals.

The Ontario and Canadian economies have experienced dramatic structural shifts in the patterns of employment over the last decade. In 1991, 18 per cent of the Ontario work force was employed in manufacturing industries (down from 25 per cent in 1980) while nearly 13 per cent of the work force was employed in either finance, insurance, real estate or business services (up from 10 per cent in 1980). Based on the results of this study, it appears that the Ontario industries with the poorest relative levels of work force skills have also been the industries which have experienced the most severe restructuring. At the same time, the Ontario work force has crucial strengths in some of the most important sectors and industries of the evolving modern economy — strengths which should be recognized and built upon.

II. Introduction

The Premier's Council on Economic Renewal has recognized the need to measure and compare Ontario's performance against those jurisdictions with which Ontario does business. At the same time, there is a growing recognition that traditional measures of economic activity fail to appropriately reflect the broad structural changes which are occurring within the economy. As a result, the Secretariat of the Council initiated the *Comparative Indicators Project* in order:

- to objectively position Ontario in North America in a competitive context;
- to focus and validate potential strategies for both the government and the province in general: for example, what level of incremental investment in education and training can be justified from an economic and social viewpoint;
- to develop and analyze new (or at least less traditional) measures of Ontario's performance which would reflect the structural shifts that are occurring in both the Ontario economy and the world economy, in general.

While monitoring Ontario's progress over time is important, it has become increasingly critical to position Ontario's performance in an inter-jurisdictional context. Globalization demands that jurisdictions no longer function in isolation from the rest of the world. The research conducted for this report focussed on Ontario's performance relative to the rest of Canada and the United States. Extending this analysis to include Canada's European and Asian trading partners could provide further insight and will be considered in light of the response to the present study.

The objective of this study is to provide an industry-specific comparison of the skill level of the Ontario work force with those of other jurisdictions. The focus is on comparisons of the educational attainment and occupational mix — proxies of skill levels — of the Ontario work force by industry with other jurisdictions in Canada and the United States.

III. Competitive Advantage and Work Force Skills

The collective skill level of the work force (or human capital or human resources) of a jurisdiction has become the most important source of competitive advantage in the world economy. Moreover, it is an advantage which can be created. Nations with few natural resources such as Japan, Switzerland and Germany (and more recently Taiwan and Korea) have built successful and competitive economies based, in large part, on the strength of their work forces.

The relationship between human resources and international competitiveness is based upon the growing influence of globalization.[1] There have been three interrelated phases to the process of globalization:

- Increased trade flows in the 1950s and 1960s;
- Growth in financial flows in the 1970s and early 1980s;
- Dramatic increases in the flows of foreign direct investment in the third and current phase.

The most important implication of this process of globalization is that international competition for foreign investment and the associated technology it brings has become extremely intense. As a result, domestic policies have become increasingly crucial as the main determinants of a jurisdiction's attractiveness. While there are many important micro and macro domestic policies, human resource policies are the most broad based and fundamental to all other policies.

Other competitive advantages are either less durable or more mobile. For example, rich endowments of natural resources have become less important as new technologies have allowed both new sources to be found and exploited and reduced the ultimate demand for natural resource commodities as inputs into the production of final goods. Similarly, technology and capital are significantly more mobile than a work force due in large part to the growing importance of multinational enterprises. As well, there is an important "virtuous cycle" which reinforces the importance of a highly skilled and knowledge-intensive work force.[2] New technologies and the modern process of innovation require a more significant knowledge base than in the past. As a result, "the rich" will be able to "get richer" in the new world of innovation and technology.

The traditional distinctions between white collar workers and blue collar workers or office workers and plant workers have become an anachronism. The appropriate new distinction in the labour force is between "knowledge workers" or highly trained, skilled workers, and unskilled workers. It is widely recognized that better educated and more highly skilled workers tend to hold jobs that are significantly better paying, more secure and more satisfying than those held by less educated, lower skilled workers. At the same time, unemployment rates are higher for persons with lower levels of education and the duration of unemployment tends to be much longer than that of individuals with higher levels of education. Collectively, Canadians face a clear choice: develop skills or accept lower wages and higher unemployment. The imperative of globalization is that unskilled Canadian workers will be forced to compete with unskilled workers from all over the world — and that competition will be based on wages.

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[1] *Human Resources in the Global Economy,* Sylvia Ostry, Centre for International Studies, University of Toronto, 1992.

[2] Ibid, page 7.

IV. Measuring Work Force Skills

While there has been general agreement among observers and analysts that improving the quality and skill of the Canadian work force represents the most important competitive challenge for government and business, there is no generally agreed upon (or understood) measure of work force skills.[3]

Work force skills are directly related to labour productivity. Estimates of the two most popular measures of labour productivity — value-added per employee and labour's share of total factor productivity — have been widely analyzed and published.[4] This body of research has identified a serious decline in the growth of Canadian productivity and has attributed this to a lack of flexibility in the Canadian economy. However, the poor performance of Canadian labour productivity growth is also likely a reflection of insufficient improvements in the quality of the Canadian (and Ontario) work force relative to our competitors. By itself, labour productivity cannot be used to accurately measure and compare work force skills across jurisdictions because a number of other factors including physical capital, technology, workplace organization and even relative prices have important effects on productivity.

The ideal measure of work force skill levels would reflect the notion of human capital and incorporate both formal and informal education and training as well as work-related experience. However, there is no simple and accurate method for compiling these disparate factors into one measure which could be compared across jurisdictions. An alternative measure of work force skill levels could be based on a set of standard industry-specific competencies. However, neither of these measures would be feasible for use in this study.

Accordingly, this study focuses on comparing educational attainment and occupational mix as readily available proxies of work force skill and quality.

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[3] *The Prosperity Initiative* of the Federal Government, *Canada at the Cross Roads* by Monitor Company, *A Lot to Learn* by the former Economic Council of Canada and *People and Skills In The New Global Economy* of the former Ontario Premier's Council all identified work force education, training and skills as crucial ingredients to improving the competitiveness of the Canadian economy.

[4] See for example *Pulling Together* by the Economic Council of Canada or "Productivity in Manufacturing Industries, Canada, Japan and the United States, 1953-1986: Was the Productivity Slowdown Reversed?" by Denny et al, *Canadian Journal of Economics*, August 1992.

i. Educational Attainment

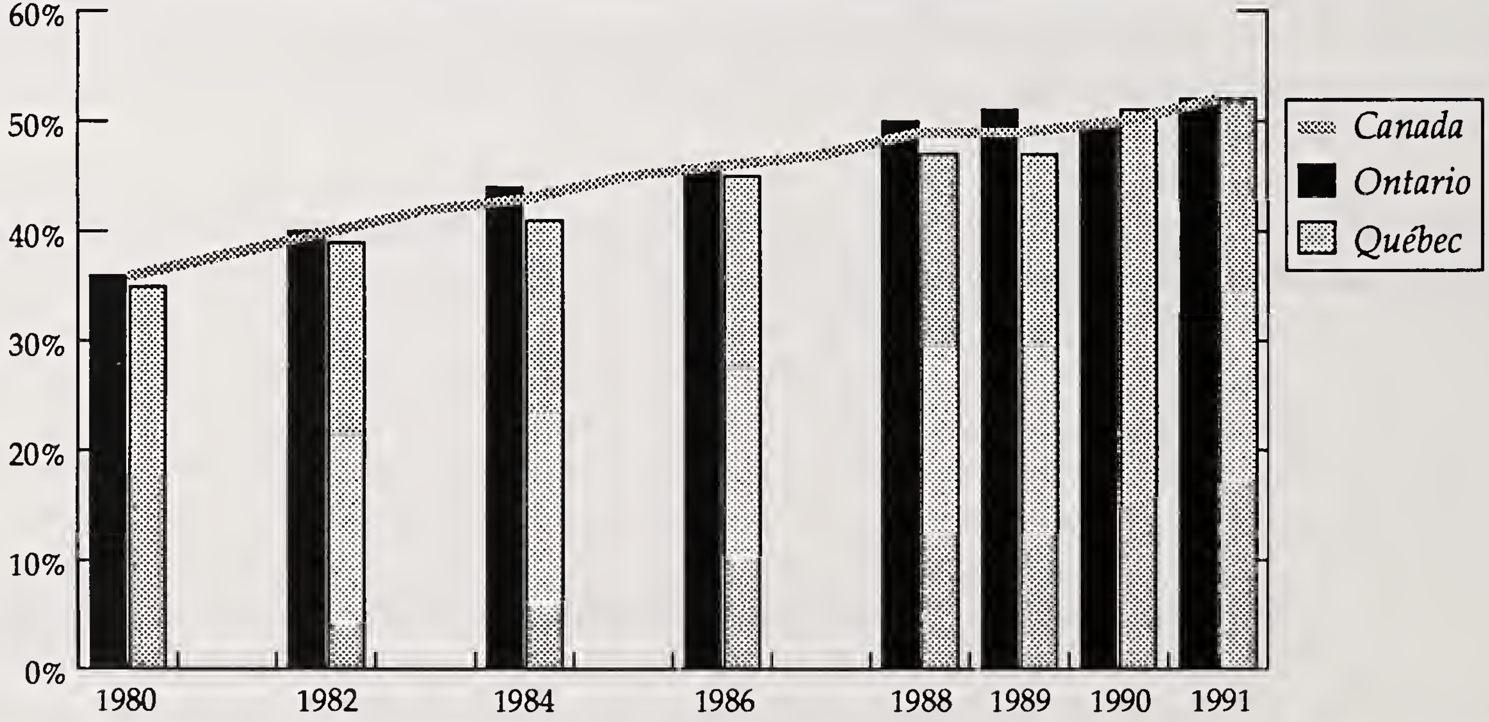
The first of these proxies of work force skills are measures which represent the share of an industry's work force[5] with a particular level of educational attainment. These measures may be interpreted as outcomes of the education system over a long period of time — outcomes to which not only traditional schooling but also adult education, training and demographics have contributed. However, it is important to recognize that because these indicators measure the educational attainment of the work force, the statistics more accurately describe how the output of the education system has been absorbed by the economy.

The best and most comparable measure of educational attainment that could be constructed using available data sources was the share of an industry's work force with *at least* "some post-secondary" education; that is the share of the work force with at least one year of education beyond secondary school. Appendix II contains a detailed description of all of the various measures of educational attainment used in this study.

By any measure, there has been a dramatic increase in the educational attainment of the work force in most industries and jurisdictions over the last 12 years (see Chart 1). The proportion of the Canadian work force with at least "some post-secondary" education has risen steadily from 36 per cent in 1980 to 52 per cent by 1991, reflecting both demographic factors and the higher incidence of unemployment among less educated workers.

CHART 1

Share of the Work Force with Some Post-Secondary Education



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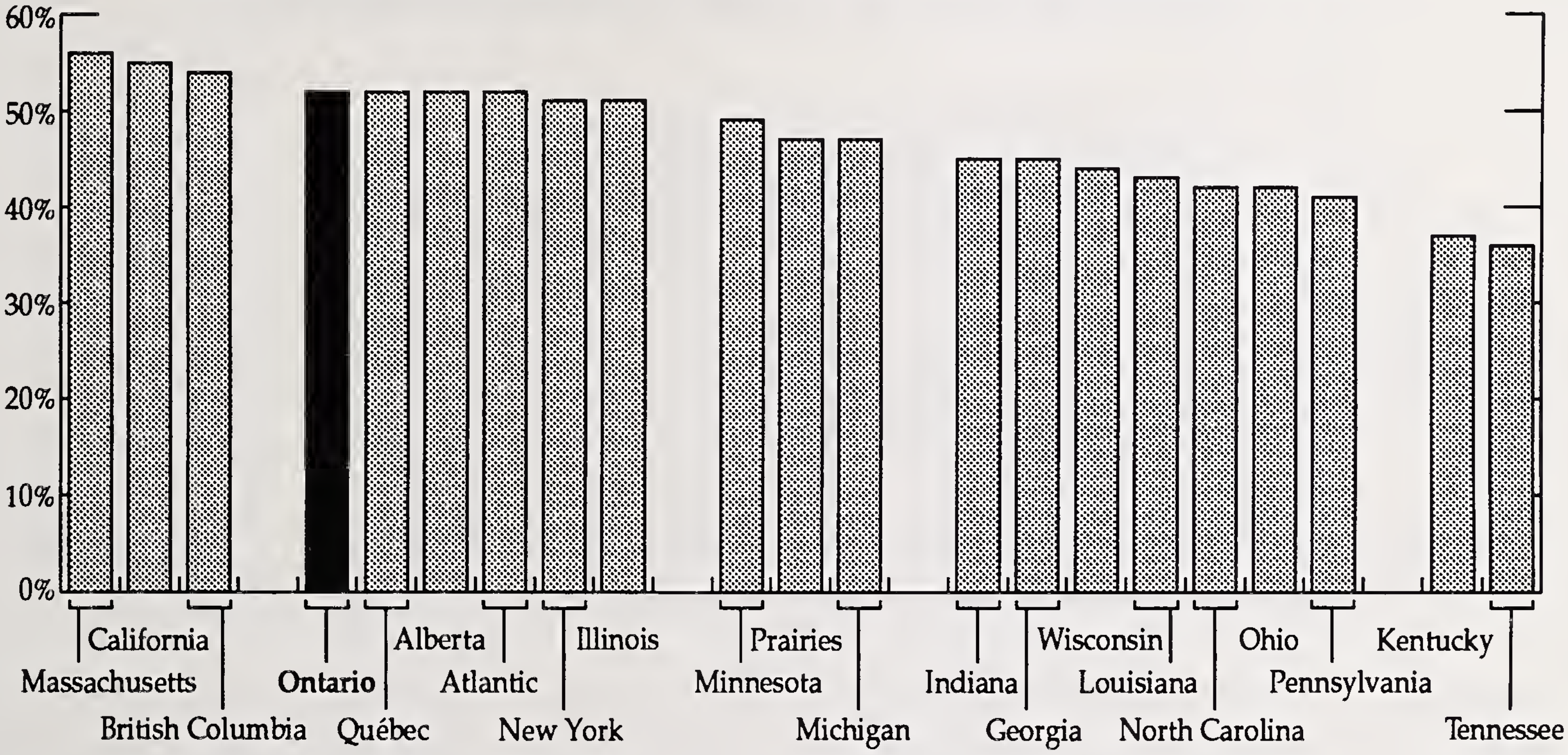
[5] Note that the term "work force" is used to refer to employed workers and not the total labour force.

The current share of Ontario's total work force with some post-secondary education compares favourably with other Canadian and U.S. jurisdictions. The educational attainment of the aggregate work forces of the jurisdictions included in this analysis can be divided arbitrarily into five tiers (see Chart 2)[6]. Based on this ranking, Ontario is among the "second tier" jurisdictions with about 52 per cent of its work force having pursued some training or education beyond secondary school. While this is somewhat lower than the first tier jurisdictions of California and Massachusetts — where 55 per cent of the work forces have some post-secondary education — it is significantly higher than the south-eastern U.S. States of Kentucky and Tennessee where less than 40 per cent of the work forces have any training beyond high school.

CHART 2

Share of the Work Force with Some Post-Secondary Education, 1991



Ontario and Québec have experienced some of the highest rates of improvement in the educational attainment of their work forces over the last 12 years. The shares of Ontario and Québec's manufacturing work forces with some post-secondary education have risen 14 and 17 percentage points respectively since 1980 as compared to increases of 12 and 10 in New York and California and just 6 and 4 in Kentucky and Tennessee (see

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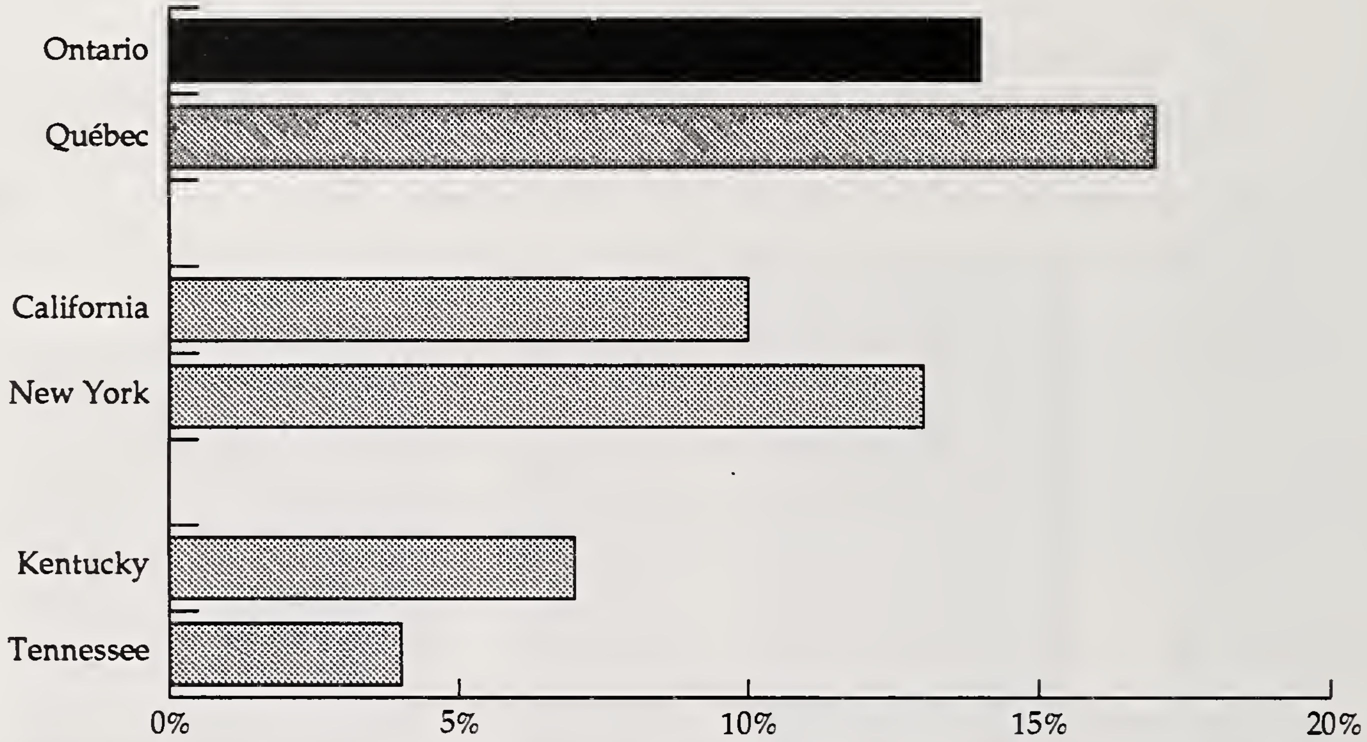
[6] Reflecting data availability, the Canadian jurisdictions included in this analysis were British Columbia, Alberta, the Prairies (Saskatchewan and Manitoba), Ontario, Québec and the Atlantic Provinces (New Brunswick, Nova Scotia, P.E.I. and Newfoundland). The U.S. States included California, Georgia, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, New York, North Carolina, Ohio, Pennsylvania, Tennessee and Wisconsin.

Chart 3). As a result of these differing rates of increase, the gap between the most- and least-educated jurisdictions has actually widened over this period. In 1980, the proportion of the Ontario manufacturing work force with some post-secondary education was 11 percentage points higher than that of Tennessee. By 1991, this difference had widened to 21 percentage points.

CHART 3

Increase in Share of Manufacturing Work Force with Some Post-Secondary Education (1980-1991)



In general, the U.S. has higher shares of university graduates among its work force than any of the Canadian regions or provinces. In 1991, 17 per cent of the Ontario work force had graduated from university as compared to 28 per cent of the Californian work force and 21 per cent of Michigan's. Similarly, all of the U.S. States had higher levels of high-school graduation among their work forces as compared to the Canadian jurisdictions. In 1991, 75 per cent of the Ontario work force had graduated from high school as compared to 90 per cent in Massachusetts, 88 per cent in Michigan and 86 per cent in California.[7]

The share of the Ontario manufacturing work force with post-secondary graduation has declined in the last four years while Québec's rose from 29 per cent in 1988 to almost 35 per cent by 1991. The Ontario machinery industry demonstrates this trend dramatically: the share of this work force with a post-secondary degree, diploma or certificate fell from 57 per cent in 1988 to 35 per cent by 1991. While this decline occurred during a severe recession, the impact of the recession has been to significantly reduce the educational attainment of the Ontario work force. In contrast, during the 1982 recession, the share of the Ontario machinery industry work force with a post-secondary degree, diploma or certificate rose from 32 per cent to 41 per cent.

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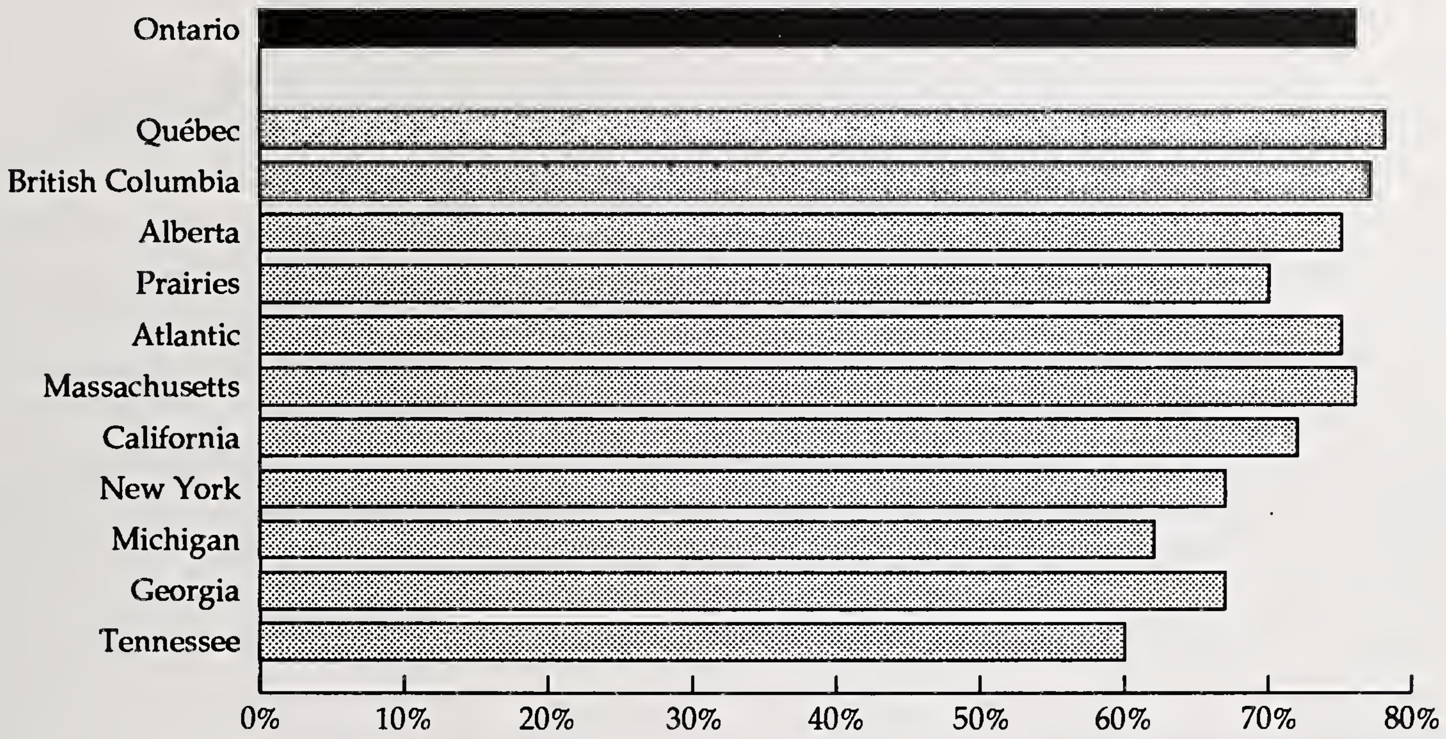
[7] Of course, the inverse of this statistic implies that one in four Ontario workers did not graduate from high school.

An analysis of specific industries reveals interesting results. The Ontario work force appears particularly well educated in some of the more important emerging industries of the new economy. For example, the Ontario business services work force has achieved one of the highest levels of educational attainment in North America. In 1991, the share of the Ontario and Québec business services work forces with some post-secondary education were among the highest in North America, at 76 per cent and 78 per cent respectively (see Chart 4).

CHART 4

Share of the Work Force with Some Post-Secondary Education

Business Services Industry, 1991

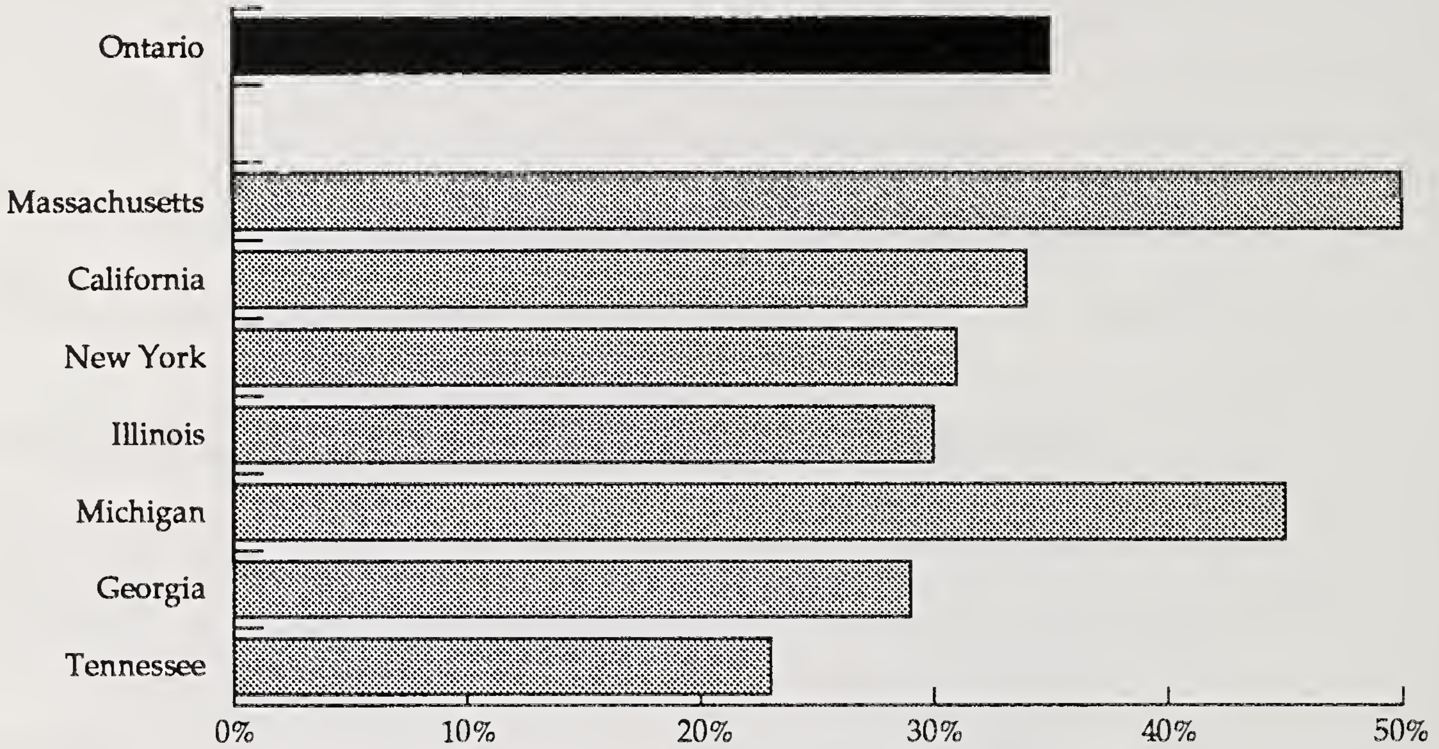


In 1991, 35 per cent of Ontario's motor vehicle industry work force had some post-secondary education, which was comparable to most U.S. jurisdictions but significantly lower than some such as Michigan, where 45 per cent of the work force had some post-secondary education (see Chart 5).[8]

CHART 5

Share of the Work Force with Some Post-Secondary Education

Motor Vehicles and Parts Industry, 1991



The share of the Ontario pharmaceutical industry work force with some post-secondary education (46 per cent) is among the lowest of the jurisdictions analyzed. This may imply that Ontario's pharmaceutical industry is more focussed on the production of pharmaceutical products as opposed to the more knowledge-intensive research and development aspects of the business. Although the pharmaceutical industry in Ontario is relatively small, representing only one-quarter of 1 per cent of total employment in the province, it represents one of the important industries of the new economy (see Chart 6).

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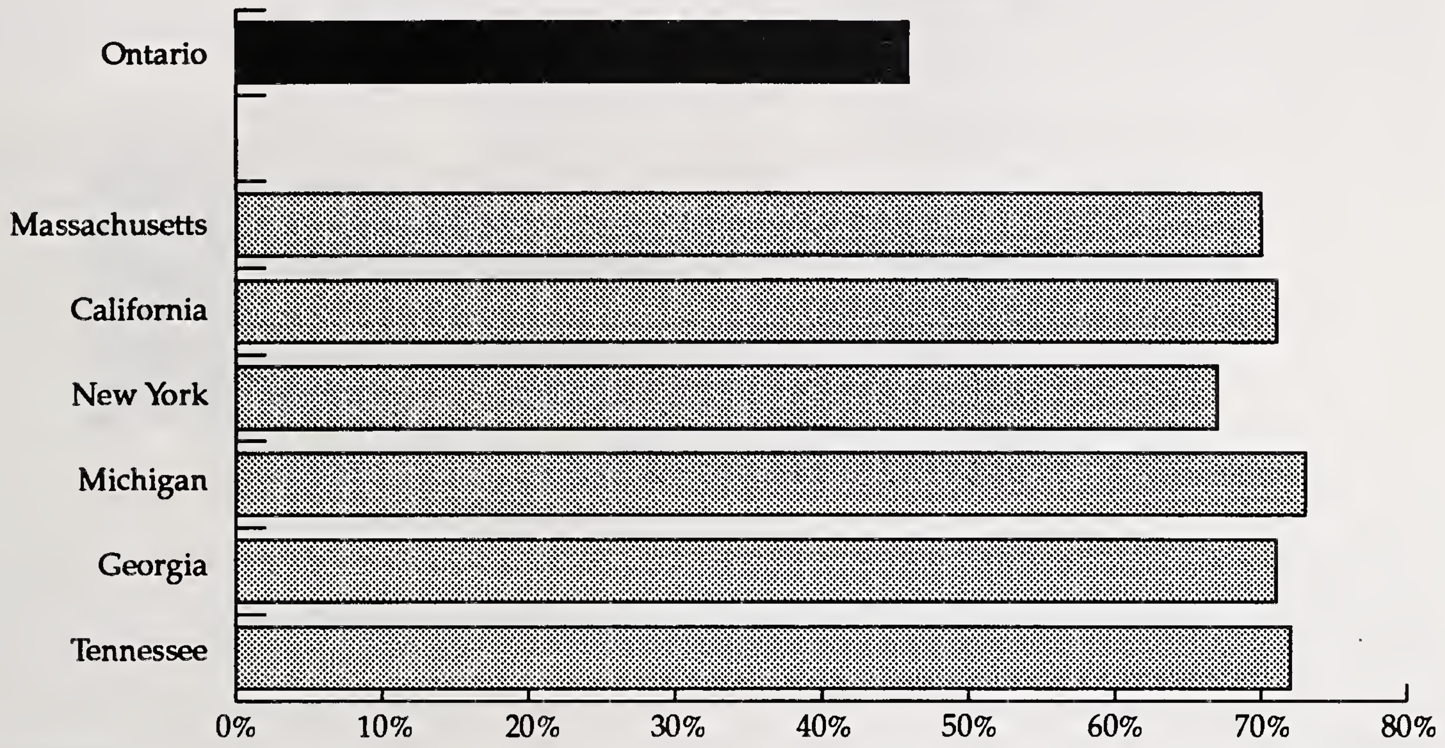
[8] While educational attainment of the Massachusetts motor vehicle industry work force is extremely high, the industry represents only about one-tenth of 1 per cent of employment in Massachusetts as compared to shares of 2.8 per cent in Ontario and 8.9 in Michigan.

CHART 6

Share of the Work Force with Some Post-Secondary Education

Pharmaceutical and Medicine Industry, 1991



In summary, the educational attainment of the Ontario work force compares favourably with most of the jurisdictions included in this analysis. It is also important to recognize that Ontario, and all of the other Canadian provinces, have experienced some of the fastest rates of improvement in the educational attainments of their work forces over the last decade. While there are significant and troubling weaknesses in the educational attainment of the work force of particular Ontario industries, there are also important strengths and these will be addressed further in the subsequent sections of this report.

ii. Knowledge-Intensive Occupations

A second proxy of the skill level of a work force is the proportion of workers in specific knowledge-intensive occupations, that is, "knowledge workers". A detailed description of the occupations included in this measure is contained in Appendix II. Essentially, knowledge-intensive occupations fall into three broad areas:

- Engineering, Natural Sciences and Mathematics (including technicians and technologists);
- Social Sciences, Teaching and Medicine;
- Management and Senior Administration.

The occupations included in this measure represent the best educated, most highly skilled, adaptable and innovative workers in an industry.[9] The objective of measuring and comparing the proportion of knowledge-intensive occupations across industries and jurisdictions lies in the implicit assumption that workers in these occupations make greater contributions to the efficiency, productivity and ultimate competitiveness of the industry than workers in other occupation categories. Workers in other categories, such as processing and clerical jobs, often perform repetitive tasks requiring fewer highly developed skills. However, the difficulty with measures of knowledge-intensive occupations is that it is not possible to accurately distinguish between different types of processing occupations. This results in certain highly skilled and innovative production workers being excluded.

While the occupations considered knowledge-intensive for purposes of the study were not systematically analyzed, there is, at the same time, nothing arbitrary about the importance of these occupations to the economy. Based on the definition described above, the importance of knowledge-intensive occupations to the economy's work force has increased dramatically over the last 12 years (see Chart 7). In 1991, 30 per cent of the Canadian work force were in knowledge-intensive occupations as compared to just 21 per cent in 1980. Total national employment in knowledge-intensive occupations grew 4.5 per cent per annum over the last 12 years (a 61 per cent increase in total) as compared to a 0.4 per cent per annum growth rate (4.9 per cent in total) in the other occupation categories. This contrast in growth rates is even more dramatic for the Ontario manufacturing industry. Knowledge-intensive occupations in this Ontario sector grew 27 per cent in total over the last 12 years as compared to a 19 per cent decline in other categories.

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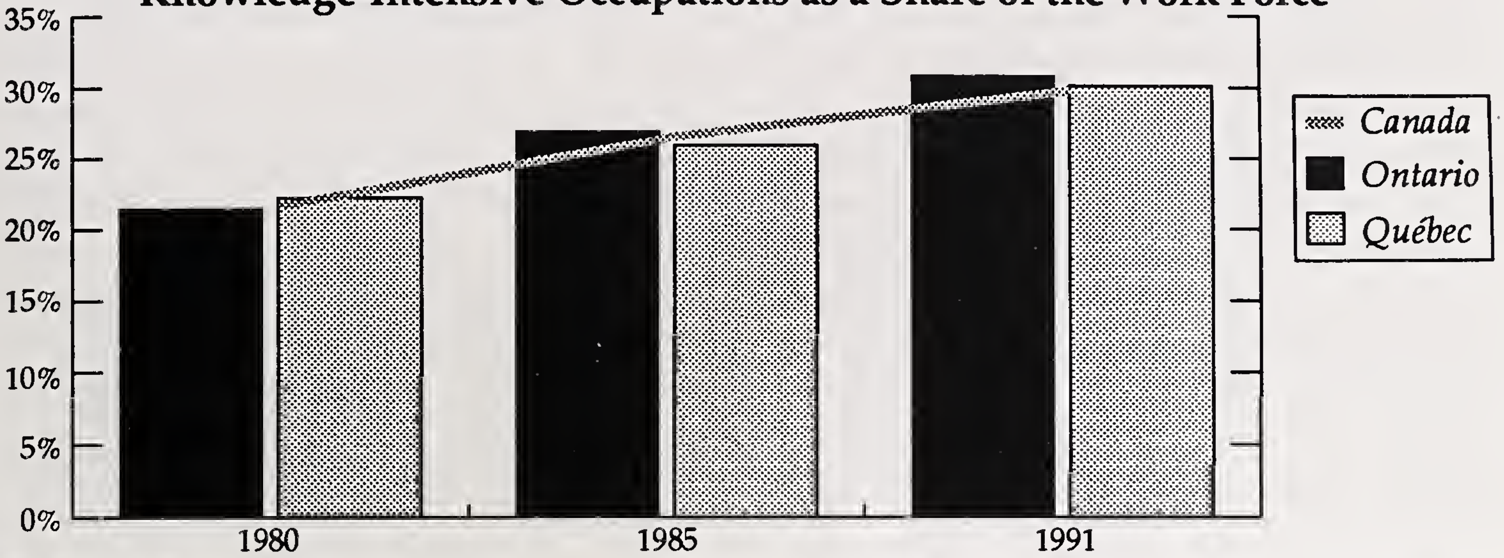
[9] There are many similarities between knowledge-intensive occupations and Robert Reich's notion of "symbolic analysts". See *The Work of Nations* (Robert Reich, 1991) and particularly Part Three of that book, "The Rise of the Symbolic Analyst".

CHART 7

Knowledge-Intensive Occupations as a Share of the Work Force

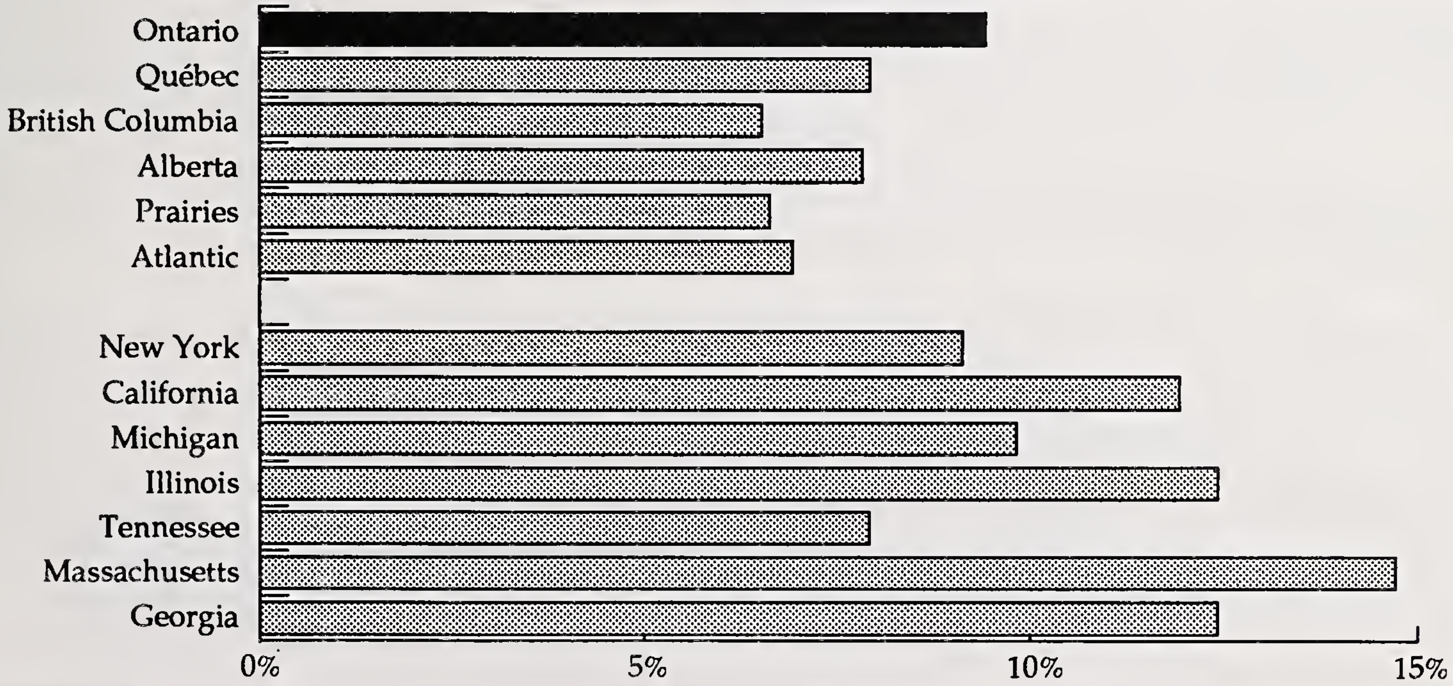


The dramatic increase in the importance of knowledge-intensive occupations to the economy has been consistent across the U.S. and Canada. Over the last 12 years, several U.S. States have experienced even more dramatic increases in the share of knowledge-intensive occupations to the total work force. In Massachusetts, for example, these occupations rose nearly 15 percentage points from just 19 per cent of the Massachusetts work force in 1980 to almost 34 per cent by 1991 (see Chart 8). As well, it is important to note that of the 9.4 percentage point increase in the share of knowledge-intensive occupations in Ontario, more than two-thirds can be attributed to increases in the share of management and administrative occupations (6.6 percentage points) while engineering, natural science and technical occupations increased their share of the work force only marginally (0.3 percentage points).

CHART 8

Increase in Share of the Work Force in Knowledge-Intensive Occupations

(Percentage Point Increases: 1980-1991)

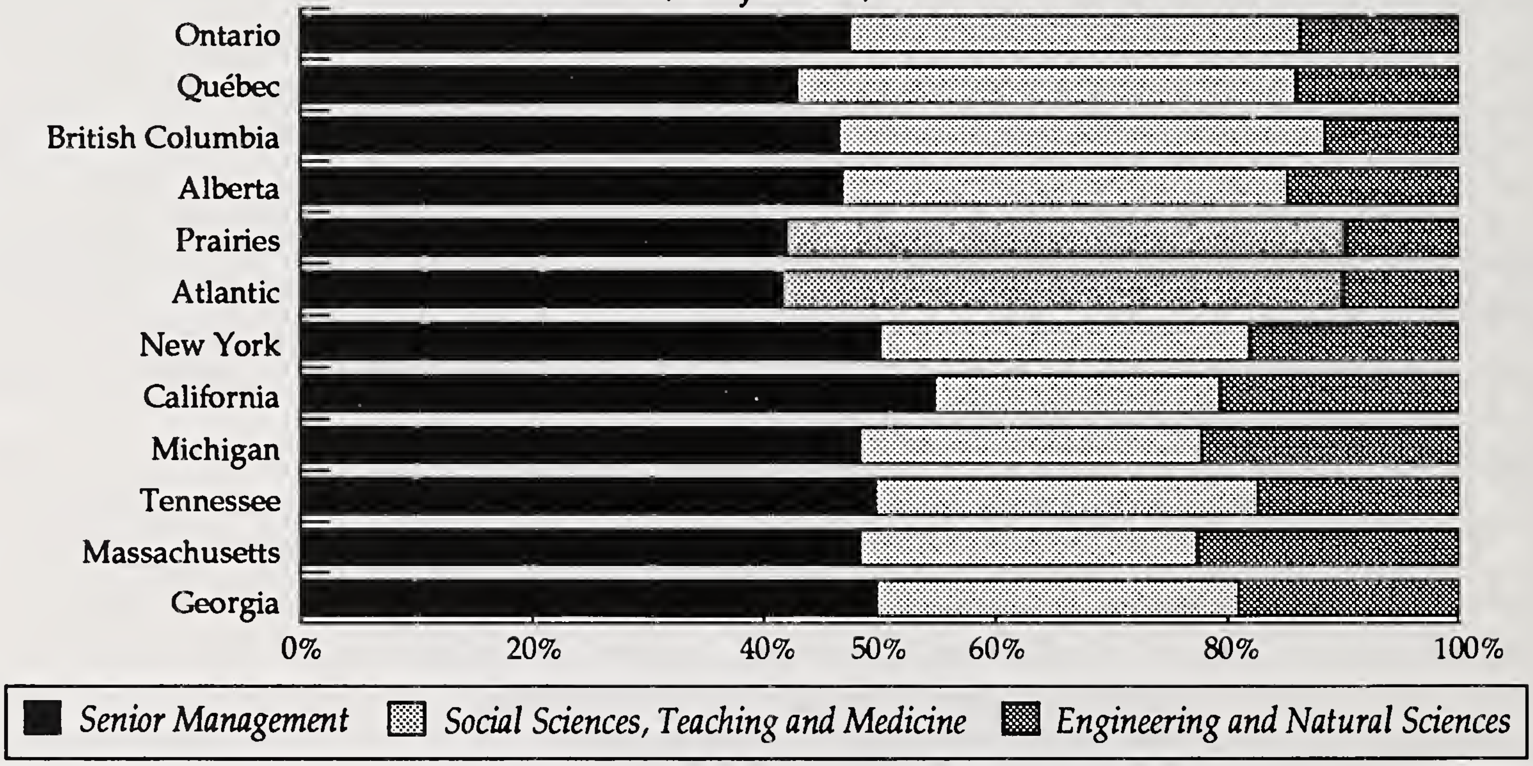


The composition of knowledge-intensive occupations differs significantly between jurisdictions. In general, Ontario and the other Canadian provinces tend to have more social science and medical professionals and fewer engineering, natural science and technical professionals than most U.S. jurisdictions. A comparison of the composition of knowledge-intensive occupations between Ontario and Michigan demonstrates this point. In 1991, 47 per cent and 48 per cent of the Ontario and Michigan knowledge-intensive occupations were senior managers or administrators. However, 38 per cent of Ontario's knowledge-intensive occupations were social science and medical professionals as compared to 29 per cent in Michigan. Just 14 per cent of Ontario's knowledge-intensive occupations were engineering or technical occupations, as compared to 22 per cent in Michigan. On average, when compared to the U.S., it appears that the Canadian economy has substituted engineering and technical professionals for additional social science and medical professionals (see Chart 9).

CHART 9

Knowledge-Intensive Occupations by Category, 1991

(% of Total)

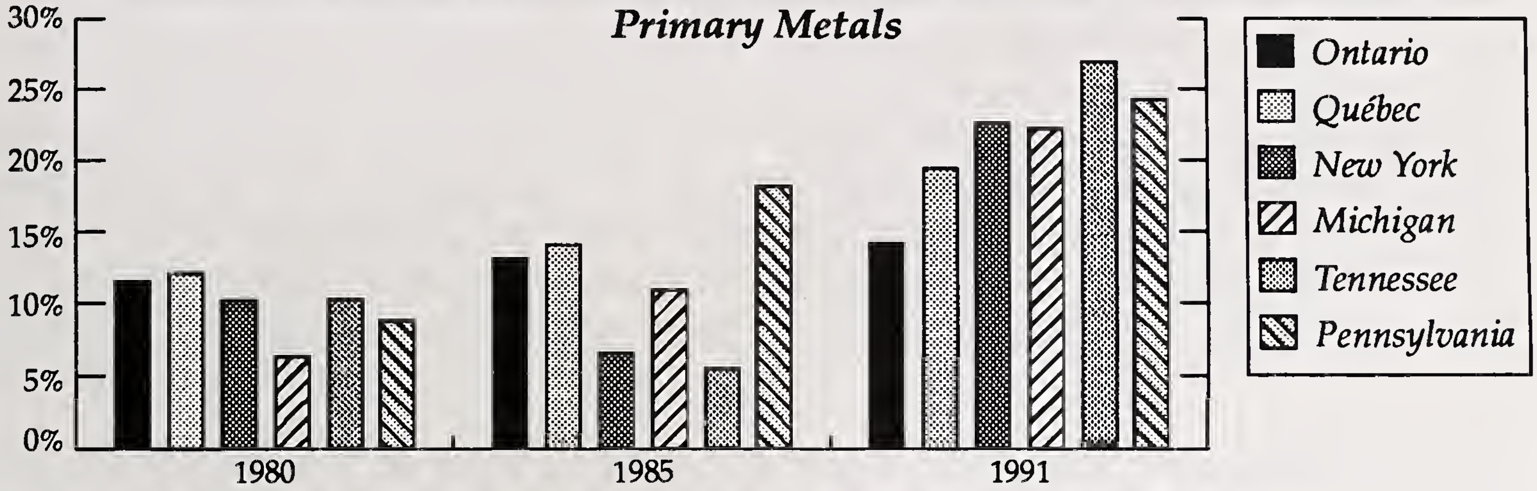


As with the comparisons of educational attainment, an analysis of the occupational mix of a number of specific industries across jurisdictions was conducted.

Over the last 12 years the share of knowledge-intensive occupations in the Ontario primary metals industry has shown little improvement, with about 14 per cent of the work force in knowledge-intensive occupations. Over the same period, the share of these occupations in the Québec primary metals work force has increased 7.4 percentage points to 19.4 per cent. There have also been strong increases in the proportion of knowledge-intensive occupations in many U.S. jurisdictions with the result that employers in most U.S. States employ significantly more workers in knowledge-intensive occupations than do employers in Ontario (See Chart 10).

CHART 10

Knowledge-Intensive Occupations as a Percentage of the Work Force

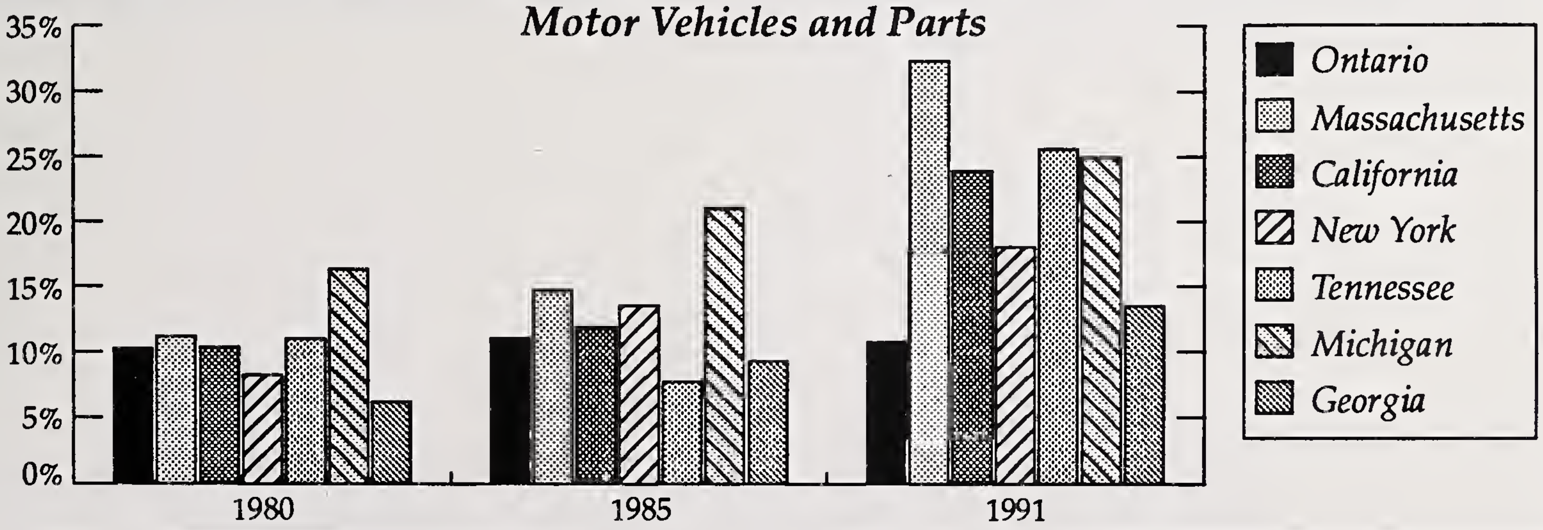

Primary Metals

A comparison of the share of knowledge-intensive occupations in the Ontario motor vehicle industry to its competitors also reveals dramatic differences. Ontario's automotive work force has remained essentially unchanged, with 11 per cent of its work force in knowledge-based occupations over the last 12 years. Over the same period, the share of these occupations in Michigan's motor vehicle industry grew from 16 to 25 per cent. In Tennessee, the share rose from 11 to 26 per cent (see Chart 11).

These shares translate into 14,000 knowledge intensive occupations in Ontario, 85,000 in Michigan and 7,000 in Tennessee, in 1991. While the Ontario motor vehicle industry has twice as many knowledge-intensive occupations as Tennessee, the Ontario work force is nearly five times larger than that of Tennessee (132,000 employees in Ontario as compared to Tennessee's 27,000 in 1991). Comparisons of both the educational attainment and knowledge-intensity of the motor vehicle industry work forces in Ontario and many of the U.S. States reflect the substantial concentrations of research, engineering and design facilities in the U.S. and the fact that the Ontario work force remains dominated by straight assembly occupations .

CHART 11

Knowledge-Intensive Occupations as a Percentage of the Work Force


Motor Vehicles and Parts

The proportion of knowledge-intensive occupations in the Ontario computer and related services industry has risen 20 percentage points over the last 12 years to 84 per cent of the work force. It leads all other jurisdictions analyzed in this study, including California, New York and Massachusetts. Moreover, nearly three-quarters of these knowledge-intensive occupations, or 61 per cent of the Ontario work force, are in engineering, natural science or technical occupations. While the industry accounts for only about 40,000 jobs or slightly less than 1 per cent of total employment in Ontario in 1991, the industry is one of the fastest growing segments of the economy[10] and includes many of the most important enabling technologies of the new economy (see Chart 12).

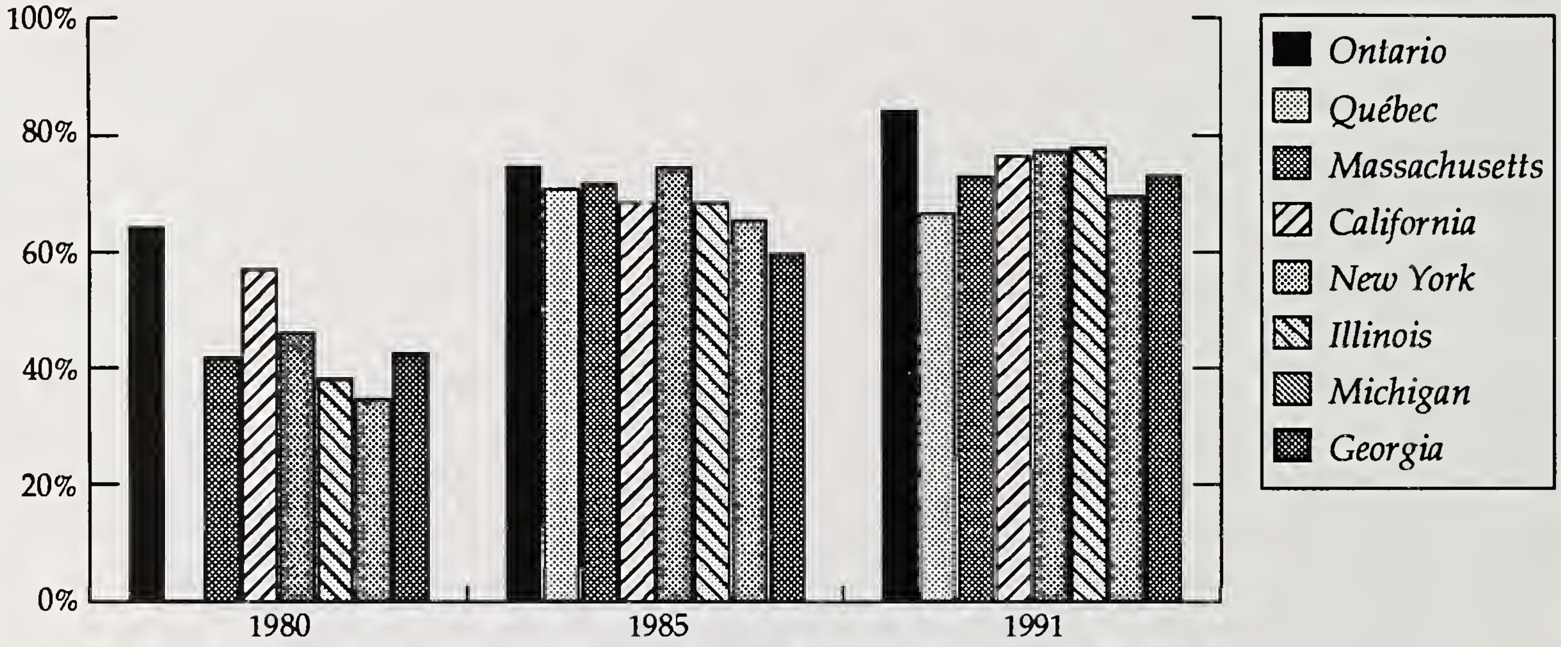


CHART 12

Knowledge-Intensive Occupations as a Percentage of the Work Force

Computer and Related Services

As with the analysis of educational attainment, an inter-jurisdictional comparison of the importance of knowledge-intensive occupations to the Ontario economy produces mixed results. On average, Ontario employs as many (or more) knowledge workers as other jurisdictions. However, this obscures both significant weaknesses and strengths in specific industries. The following section will examine these proxies of work force skills and relate them to the wages workers receive.

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[10] Employment in the Ontario Computer and Related Services Industry grew at nearly 12 per cent per annum over the last 12 years as compared to a growth rate of just 1.6 per cent per annum for total economy-wide employment.

V. Educational Attainment, Knowledge-Intensive Occupations and Wages

One of the principal shortcomings of measures of generic educational attainment of the work force is that they fail to distinguish between disciplines of study. For example, in measuring post-secondary educational attainment, a graduate of chemical engineering would not be differentiated from a graduate of English literature, though their skills would be valued quite differently by the chemical industry. However, measures of the occupation mix of the work force would likely address this problem since the engineering graduate would be included among the knowledge-intensive occupations for the chemical industry while the graduate of English literature would probably be excluded.

However, measures of the knowledge-intensive occupation mix of a work force cannot alone capture the skill level of a particular industry. Indeed, it is possible to argue that a particularly high share of knowledge-intensive occupations in an industry could be a reflection of high overhead and therefore be unrelated to the skill or quality of that work force. In the new, innovation-based economy, the most competitive firms organize work around highly skilled and well-paid workers and as a result these firms might not have particularly high concentrations of knowledge-intensive occupations.

Although the occupations considered knowledge intensive for purposes of this study included technicians and technologists, the problem is that some highly skilled, technically demanding (and certainly knowledge-intensive) processing occupations would end up being excluded. Fortunately, indicators of educational attainment would capture industries which employ highly skilled workers since these people would have pursued some training beyond secondary school even if their industries do not have particularly high shares of knowledge-intensive occupations. In summary, the accurate identification of a highly skilled work force is not straightforward and at a minimum both educational attainment and occupation mix should be considered simultaneously.

At the same time, there is (or at least, should be) a direct relationship between a highly skilled work force and the wages that work force receives. To allow a comparison of educational attainment, knowledge intensity and wages on one chart, it is necessary to convert each of the measures into indices based upon weighted averages of the indicators.[11]

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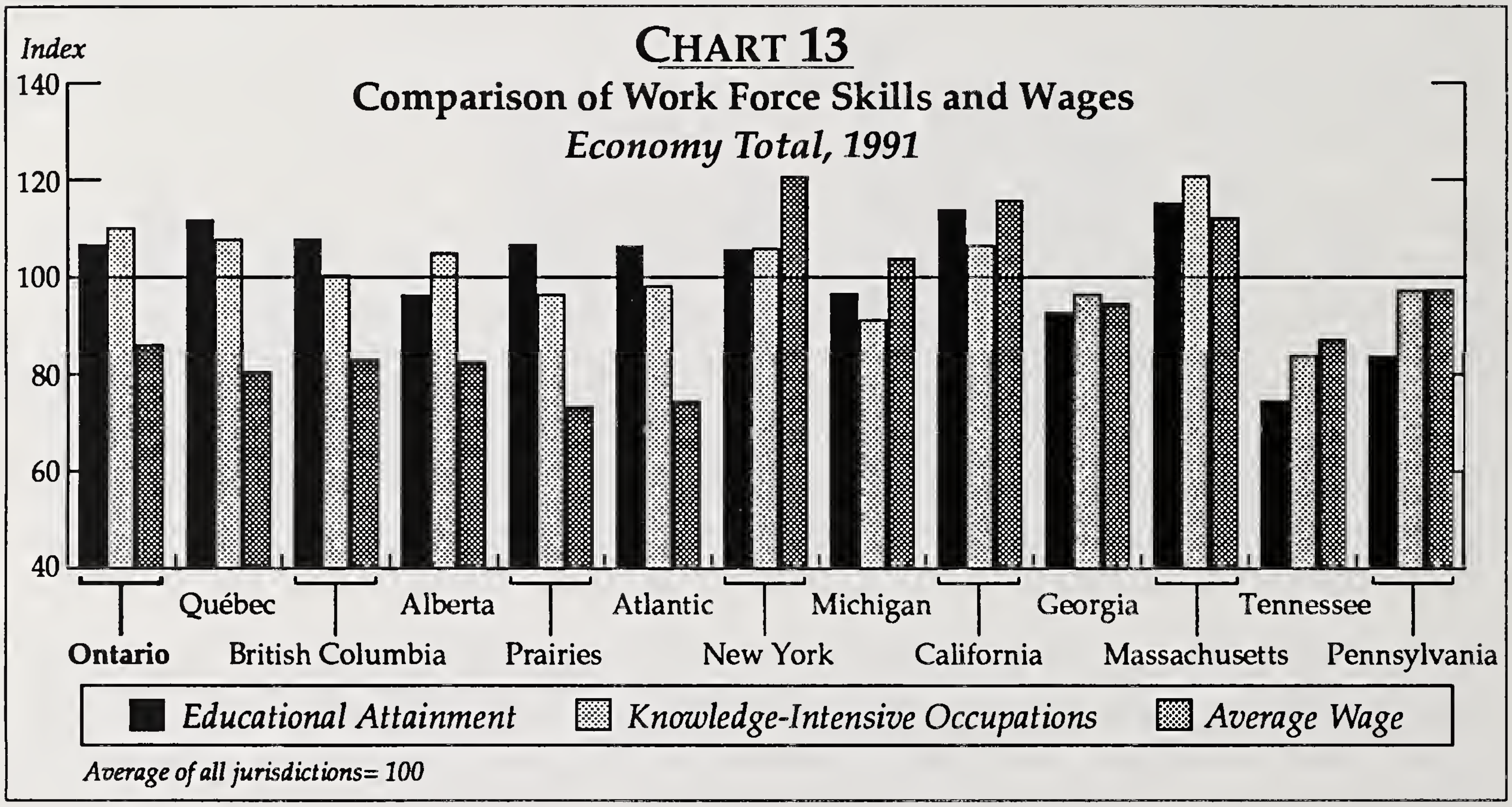
[11] A detailed definition of the wages used for this study (actually average weekly wages) is contained in Appendix I.

Chart 13 compares indices of the educational attainment, knowledge intensity and wages of the economy-wide work force. The values of the Ontario indices of educational attainment and knowledge-intensity at 107 and 110, imply that educational attainment and knowledge intensity in Ontario are 7 per cent and 10 per cent higher than the average of the jurisdictions included in this analysis in 1991.[12] At the same time, wages in Ontario are 14 per cent lower than this average in 1991. In short, the Ontario work force is more educated and knowledge-intensive (ie. skilled) than average while average weekly wages in Ontario appear competitive in comparison to most of the U.S. States.[13]

Chart 13 also demonstrates that there is a positive relationship between skills and wages. The work forces of California, New York and Massachusetts are all above average in terms of both skills (educational attainment and knowledge intensity) and wages, while the work forces of Georgia and Tennessee have below average skills and wages. Based on this chart, the work forces in all regions of Canada appear very competitive in comparison to the U.S., by offering higher than average skills for lower than average wages.

CHART 13



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[12] The 15 States included in this analysis represent almost 60 per cent of total employment in the U.S.

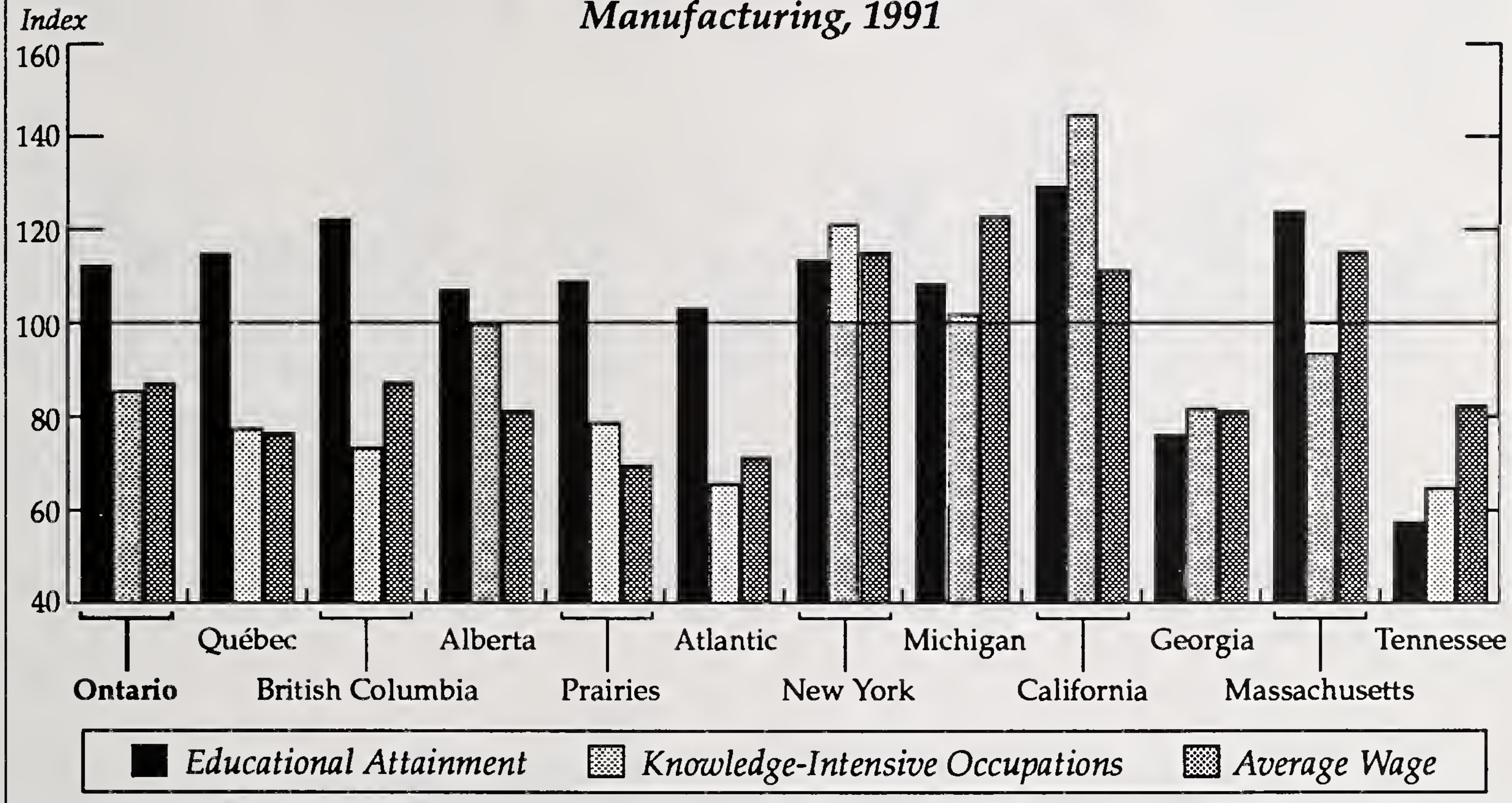
[13] The average U.S. wage is based on the 15 States used in this analysis. This is likely an overstatement of the actual average U.S. national wage because of the dominance of the high wage States of New York, Massachusetts and California. While this bias does not affect Ontario's relative position as compared to Michigan, for example, it does make Ontario's wages appear relatively lower compared to this average than they otherwise would be if all U.S. States had been included in the analysis.

Based on educational attainment, the Canadian manufacturing work force also appears quite competitive, with above average levels of education and below average wages (see Chart 14). Indeed, only the "low cost" States of Georgia and Tennessee, which rank low for educational attainment, have wage levels comparable to the Canadian jurisdictions. However, at the same time, the Canadian jurisdictions (with the exception of Alberta) also have significantly lower levels of knowledge-intensive occupations. Moreover, what this chart does not show is that the share of engineering, natural science and technical occupations is significantly lower in Canada than in the U.S. In 1991, 5.9 per cent of the Ontario manufacturing work force were in engineering, natural science or technical occupations, as compared to 14.6 per cent in California, 11.6 in Michigan and 12.7 in New York.

CHART 14

Comparison of Work Force Skills and Wages

Manufacturing, 1991



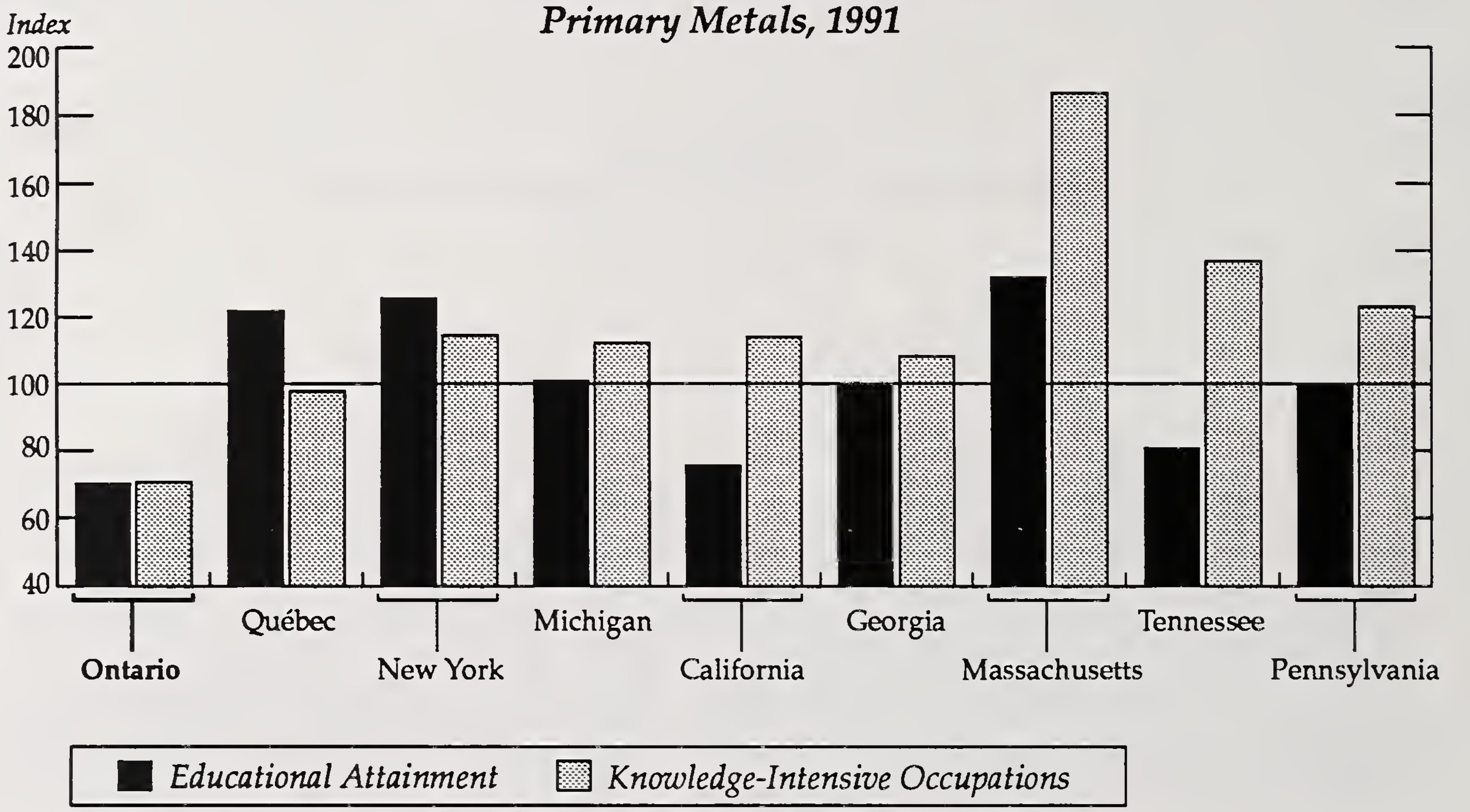
Average of all jurisdictions= 100

As noted in previous sections of this report, the Ontario primary metals industry appears particularly weak in comparison to other jurisdictions included in this study (see Chart 15).[14] The educational attainment and knowledge intensity of the Ontario work force were nearly 30 per cent lower than the average of all jurisdictions and significantly lower than specific competitors such as Québec, New York, Michigan and Pennsylvania.

CHART 15

Comparison of Work Force Skills

Primary Metals, 1991



Average of all jurisdictions= 100

The Ontario transportation equipment industry (including the motor vehicles and parts industry) also appears relatively weak, based on these measures of educational attainment and knowledge-intensity (see Charts 16 and 17). While Ontario (and Québec) wages appear quite competitive relative to other jurisdictions, it appears that these relatively low wages are strongly correlated to the educational attainment and occupational mix of these work forces. It is only those jurisdictions with high levels of both educational attainment and knowledge-intensive occupations that also enjoy above average wages.

A clear, but perhaps difficult, conclusion of this analysis, is that the real competition for the Ontario transportation equipment industry is the "low cost" U.S. States, such as Tennessee, not the high skilled, technologically intensive States of Michigan and California. Even Georgia can claim significantly higher levels of educational attainment, knowledge-intensive occupations and wages than can either Ontario or Québec.

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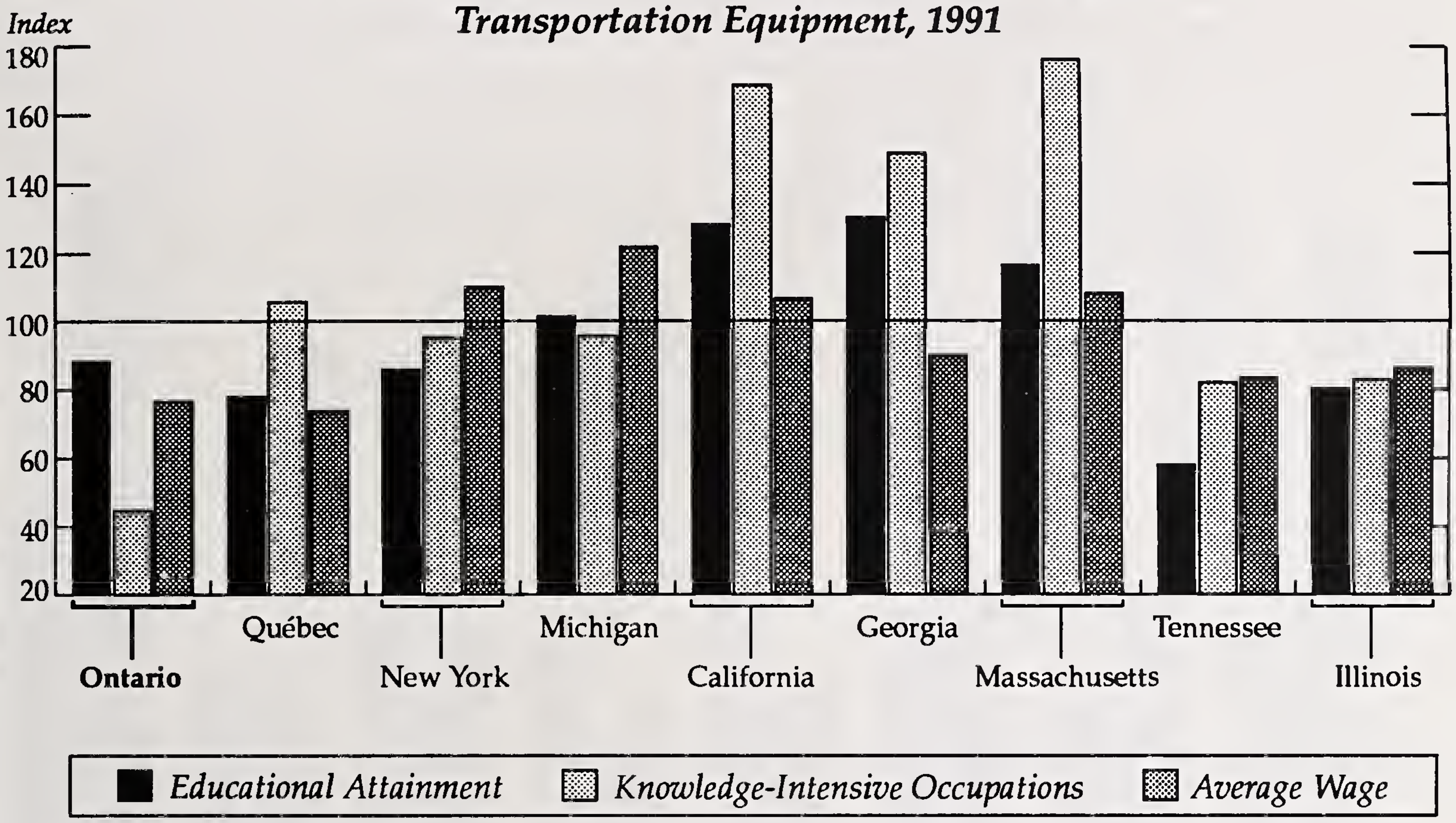
[14] Note that U.S. wages for this industry were unavailable.

CHART 16

A Comparison of Work Force Skills and Wages

Transportation Equipment, 1991

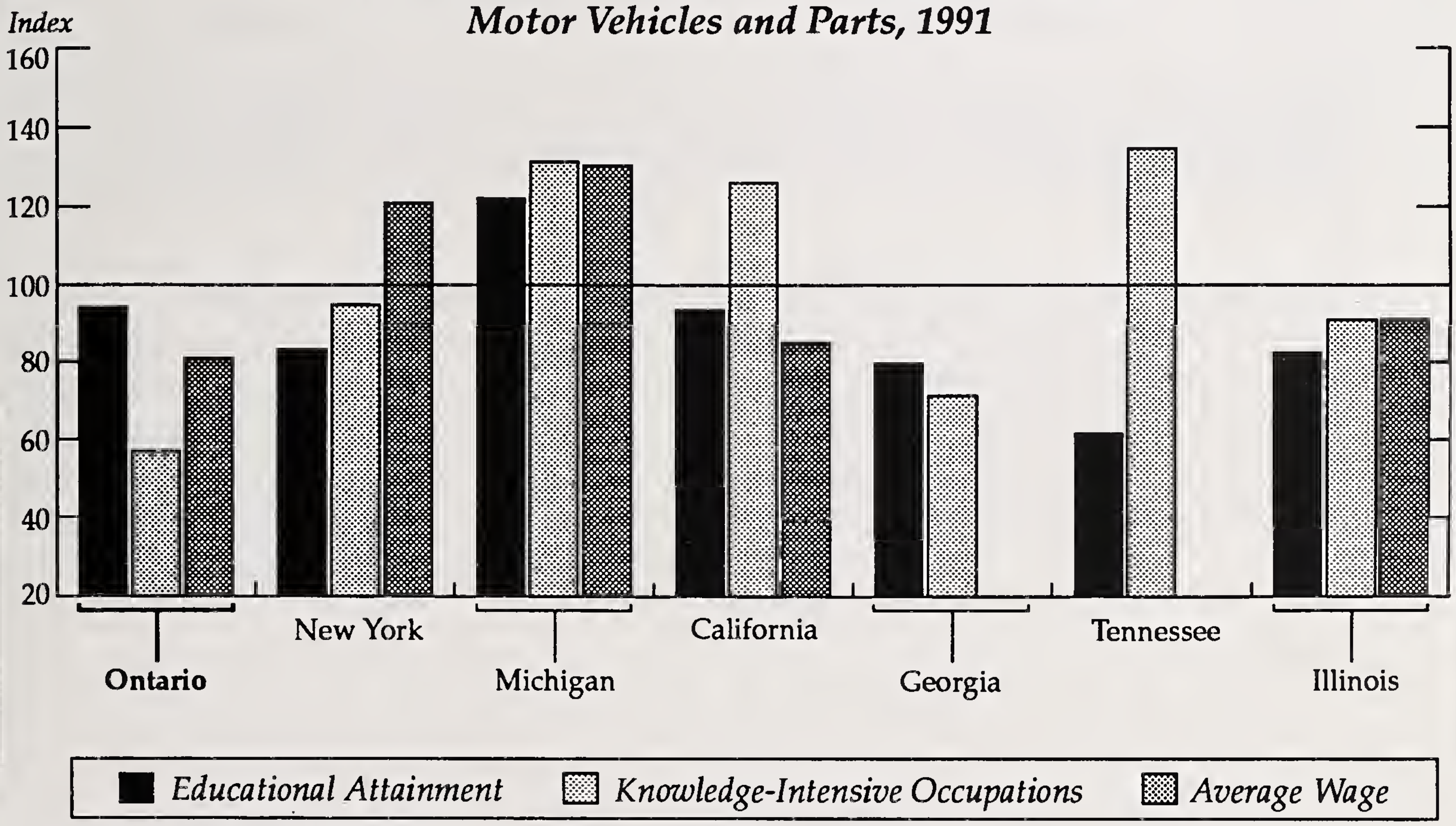


Average of all jurisdictions= 100

CHART 17

A Comparison of Work Force Skills and Wages

Motor Vehicles and Parts, 1991



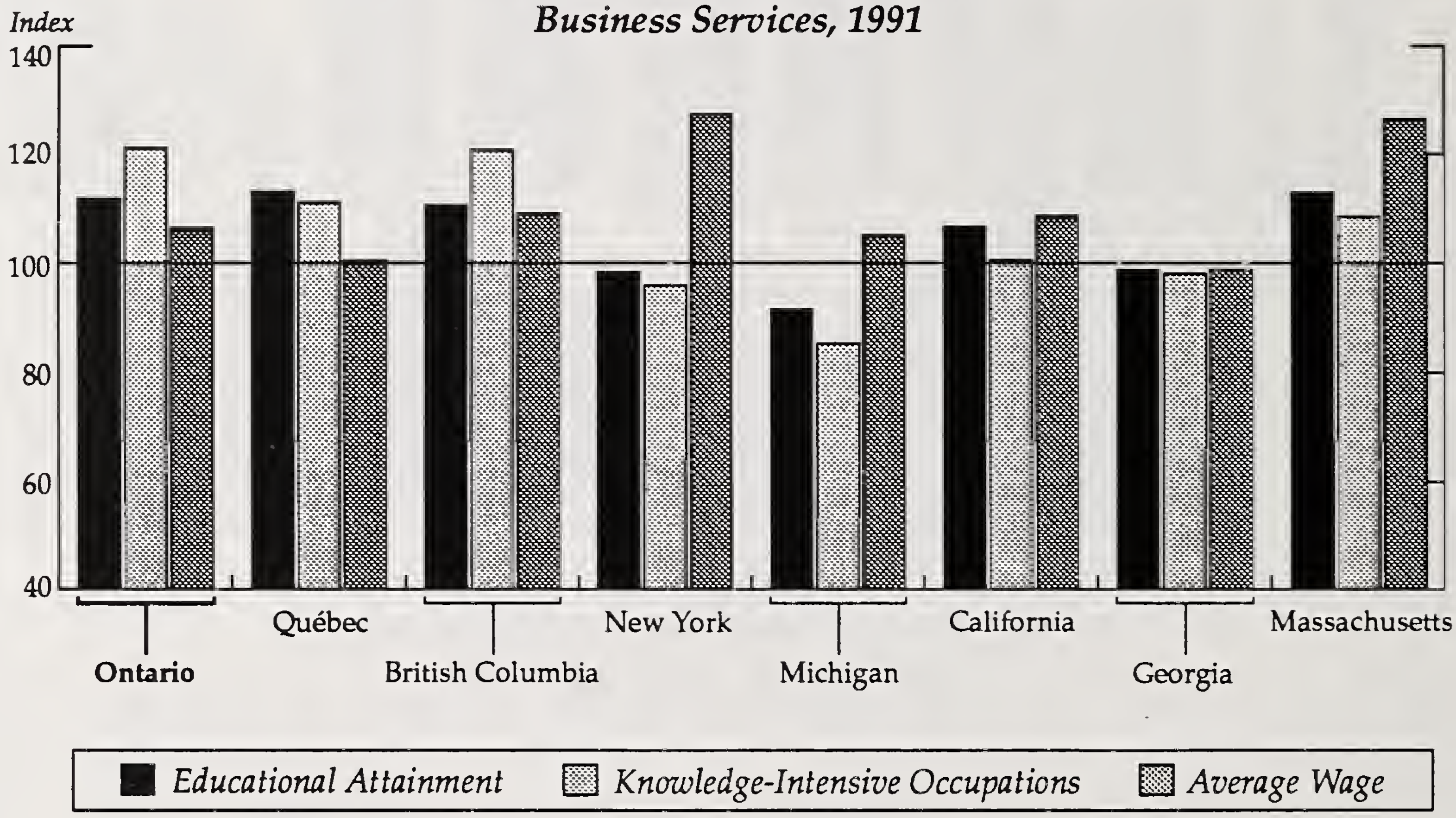
Average of all jurisdictions= 100

An important conclusion of this analysis is that all Canadian jurisdictions appear extremely competitive in the business services industry. The business service work forces in all Canadian regions or provinces have some of the highest levels of educational attainment and knowledge intensity and most competitive wages of the jurisdictions analyzed (see Chart 18). An important component of the business services industry is the computer and related services industry. Ontario's computer service work force is the most skilled (in terms of educational attainment and knowledge-intensive occupations) of all the jurisdictions analyzed (see Chart 19).

CHART 18

A Comparison of Work Force Skills and Wages

Business Services, 1991



Average of all jurisdictions= 100

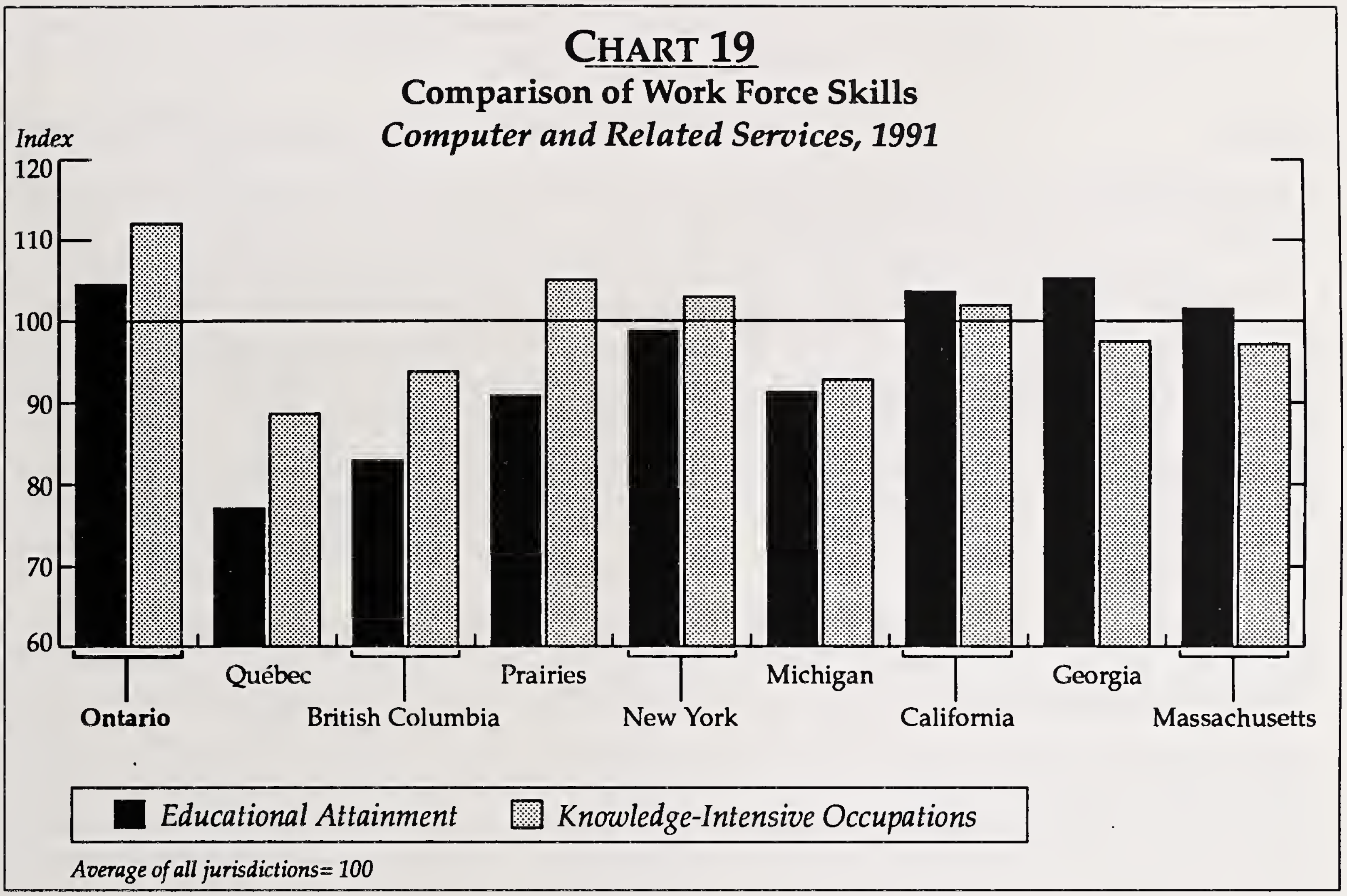


CHART 19

Comparison of Work Force Skills

Computer and Related Services, 1991

Average of all jurisdictions= 100

The following table summarizes Ontario's performance (that is leading or lagging) relative to the average for all jurisdictions in selected sectors and industries based on the two proxies of work force skill analyzed in this study: educational attainment and knowledge-intensive occupational mix. The value in parenthesis refers to the percentage by which Ontario leads or lags the average. While the Ontario work force competes with the most efficient and competitive work forces in the world — and not with a hypothetical average — the table is a useful summary of the principal findings of this study.

Based on measures of educational attainment and knowledge intensity, the Ontario work force is most competitive in service industries such as finance, insurance, business services (including computer services), health and education and certain manufacturing industries such as chemicals and electrical and electronic products. At the same time, Ontario is least competitive in the manufacturing industries commonly thought to be Ontario's strengths such as transportation equipment (including motor vehicles and aircraft), machinery, and primary metals.

Ontario's Comparative Work Force Skills[15]
Summary Table, 1991

Industry	Educational Attainment	Knowledge-Intensive Occupations
Economy Average	Lead (7%)	Lead (10%)
Mining	Lag (-24%)	Lag (-33%)
Manufacturing	Lead (12%)	Lag (-15%)
Food and Beverages	Same	Lag (-15%)
Logging, Forestry and Wood Products	Lag (-20%)	NA
Paper and Allied	Lag (-25%)	Lead (14%)
Primary Metals	Lag (-28%)	Lag (-28%)
Fabricated Metals	Lead (22%)	Lag (-10%)
Machinery	Lag (-20%)	Lag (-25%)
Transportation Equipment	Lag (-12%)	Lag (-55%)
Aircraft	Lag (-47 %)	NA
Motor Vehicles and Parts	Lag (-6%)	Lag (-43%)
Electrical and Electronic Products	Lead (14%)	Lead (8%)
Chemical and Chemical Products	Lead (17%)	Lead (10%)
Pharmaceuticals	Lag (-31%)	Lead (12%)
Construction	Lead (28%)	Lag (-10%)
Transportation	Same	Same
Communication	Lag (-9%)	Lag (-19%)
Other Utility	Lead (26%)	Lag (-8%)
Finance, Insurance and Real Estate	Same	Lead (12%)
Deposit Accepting Intermediary	Lead (7%)	Lead (13%)
Insurance	Same	Lead (58%)
Real Estate	Lag (-6%)	Lag (-30%)
Business Services	Lead (11%)	Lead (21%)
Computer and Related Services	Lead (5%)	Lead (12%)
Government Services	Lead (6%)	Lead (25%)
Education Services	Lead (4%)	Lead (21%)
Health and Social Services	Lead (16%)	NA

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[15] This table compares Ontario's performance relative to an average of the jurisdictions included in this analysis.

Appendix I: Data Sources

i. Canada

The source of the Canadian educational attainment and occupation data was a special tabulation of the Labour Force Survey (LFS). Employment data by level of educational attainment was tabulated by industry, region or province and year. The LFS is a monthly survey of 48,000 households across the country involving about 100,000 respondents. The sample was designed to represent all Canadian residents aged 15 and older, with the following exceptions: people in the Yukon and Northwest Territories, inhabitants of Indian reserves, inmates of institutions, and full-time members of the Armed Forces. In addition to labour force data, the survey collects socio-economic information such as age, sex, marital status and of course the level of educational attainment and occupation.

Average weekly earnings, by industry and province or region, were obtained from the establishment-based "Employment, Earnings and Hours" survey. Gross taxable weekly payrolls from this survey are divided by the number of employees to obtain average weekly earnings. Excluded from the payroll dollar amounts are taxable allowances and benefits, lump sum special payments, certain types of non-wage compensation as well as employer contributions to unemployment insurance, Canada/Québec pension plans, provincial medical plans, worker's compensation and other welfare plans.

ii. United States

The source of the U.S. educational attainment and occupation data was a special tabulation of the Current Population Survey (CPS). Like the LFS, the CPS is a monthly survey of about 60,000 households designed to collect personal, occupational and other statistics of the employed, unemployed and persons not in the labour force. The survey is compiled for the Bureau of Labor Statistics by the Bureau of Census. The surveys are conducted through a scientifically selected sample designed to represent the civilian non-institutional population. Respondents are interviewed to obtain information about the employment status of each member of the household 16 years of age and older.

Total payrolls by industry and State were obtained from the Bureau of Economic Analysis' "Survey of Current Business". These total payrolls include gross wages and salaries, bonuses, tips and other gratuities but do not include employer contributions to old age, survivors', disability, and health insurance (OASDHI), unemployment insurance, worker's compensation and private pension and welfare funds.

Appendix II: Methodology

i. Educational Attainment

The categories of educational attainment differed across sources:

Canadian Educational Attainment Levels	U.S. Educational Attainment Levels
1. 0-8 years	1. Less than 8 Years
2. Some secondary school	2. 1-3 Years of High School
3. Completed secondary school	3. High School Completed
4. Some post-secondary	4. 1-3 Years of College
5. Post-secondary certificate or diploma (non-degree)	5. 4 Years of College
6. University Degree	6. 5 Years or more of College completed.

The two surveys are largely comparable across countries up to the level 'Some post-secondary"; that is, level 4.

One of the maintained assumptions of this study is that the quality of education is comparable across jurisdictions so that 16 years of education in Ontario is equivalent to 16 years of education in New York. Assuming the equivalence of education across jurisdictions, then the two most important differences between the sources are:

- inability to distinguish between non-university and university programs in the U.S.

- inability to distinguish between post-graduate and professional programs in Canada.

Three indicators were constructed based on this information:

1. **The best and most comparable measure of educational attainment that could be constructed using this data is the proportion of the work force in any industry and jurisdiction with *at least some* post-secondary education.** In both surveys, this is the ratio of the sum of levels 4 to 6 to total employment. Unfortunately, it is not possible to identify only those workers who have completed or graduated from a post-secondary program in a consistent way across surveys. As a result, the indicator literally accounts for the share of the work force with at least one year of (ie. some) post-secondary education.

   Some post-secondary education in Canada includes industry recognized certifications outside of the formal post-secondary education system.

While this measure is quite broad (grouping industry certifications with post-graduate degrees), it reflects the proportion of the work force that have pursued education beyond the minimum required and to some extent have specialized in a particular field. To the innovation-based economies of the 1980s and 1990s, this is one of the most important summary statistics of the skill level of the work force.

2. The proportion of the work force in any industry and jurisdiction with at least secondary school completion. In both surveys this is the ratio of the sum of levels 3 to 6 to total employment.

   It is important to note that the U.S. survey (CPS) is of the population aged 16 and over, while the Canadian survey (LFS) is of the population aged 15 and over. This difference would explain some of the disparity between the proportion of the U.S. and Canadian work forces with high school graduation. While the proportion of the work force with secondary graduation is no longer a good indicator of the skill level of the work force of a particular jurisdiction, it is a useful summary statistic of the minimum required level of education in a modern economy.

3. The proportion of the work force in any industry and jurisdiction with university graduation. In Canada this is the ratio of level 6 to total employment, while in the United States it is the ratio of the sum of levels 5 and 6 to total employment.

   In Canada, this measurement is actual graduation from an accredited university while in the U.S. the measurement is four or more years of post-secondary education (which could include community college graduates). The measure ignores two-year college degrees in the U.S. As a result and given the relatively large differences in this statistic between Canadian and U.S. jurisdictions, it is not clear without further review if this is an appropriate comparison.

ii. Knowledge-Intensive Occupations

The definition of knowledge-intensive occupations used in this study can be decomposed into three broad categories of occupations:

1. Engineering, Natural Sciences and Mathematics (including technicians and technologists);

2. Social Sciences, Teaching and Medicine;

3. Management and Senior Administration.

This is a non-scientific classification based on professions that place an emphasis on knowledge and skill and is not intended to imply that other occupations, as a rule, are not knowledge-intensive. The occupations included in the measure are based on both the Canadian and U.S. Standard Occupation Classification (SOC) systems. The table below provides an outline of the components of the definition and the mapping which was employed between sources:

Knowledge-Intensive Occupations[16]

Canadian 1980 SOC		**U.S. 1980 SOC**	
Natural Sciences, Engineering and Mathematics	21	Computer, Mathematical and Operations Research	17
		Computer Equipment Operators	
		Engineers, Surveyors, Architects	16
		Natural Scientists	18
		Engineering and Related Technologists and Technicians	37
		Technicians; except Health, Engineering, and Science	39
Medicine and Health	31	Physicians and Dentists	26
		Other Health Diagnosing and Treating Practitioners	28
		Health Technologists and Technicians	36
Teaching and Related	27	Teachers, except Post-secondary	23
Social Sciences and Related	23	Teachers; College and University and Other Post-secondary	22
Managerial, Administrative and Related	11	Officials and Administrators, Other	12-13
		Officials and Administrators, Public Admin.	11
		Management and Related	14
		Lawyers and Judges	21

The Canadian SOCs tend to be more industry specific while the U.S. SOCs tend to reflect the process of a particular occupation (i.e. the type of machine used). This difference is most evident in the production-related occupations.

A good argument can be made for the inclusion of technical sales positions in the definition of knowledge-intensive occupations. However, it was not possible to identify this specific occupation from the available Canadian data without introducing a significant bias. As a result, to ensure greater comparability, occupations related to technical sales were excluded from the definition.

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[16] The above mapping is based on a Statistics Canada Standards Division publication, *Concordance Tables between the 1980 Standard Occupational Classifications of Canada and the United States of America*, Statistics Canada, May 1991.

iii. Average Weekly Earnings in Canadian Dollars

In the U.S., total payrolls by industry and State were divided by total employment and then by 52 weeks to yield average weekly earnings. Finally, average weekly wages by industry and State were converted into Canadian dollars using $1.315 Cdn./U.S. — a purchasing power parity estimate of the exchange rate for 1991.[17]

iv. Industry Mapping

The mapping of Canadian Standard Industrial Classification (SIC) industries to U.S. SIC industries was based on approximate linkages between appropriate two and three-digit industries. A more accurate comparison requires four-digit U.S. industries linked to three-digit Canadian industries. However, the purpose of this study was not to provide detailed comparisons of all Canadian three-digit industries to their U.S. counterparts but rather approximate (and largely accurate) comparisons of sectors and some industries (that is two and some three-digit industries) across jurisdictions.

Appendix III: Data Tables

A separate document containing detailed tables and charts of the data developed and analyzed for this study is available on request from the Secretariat of the Ontario Premier's Council on Economic Renewal.

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[17] The appropriate value of the exchange rate for comparisons of this type is a highly contentious issue. The objective is to use an exchange rate which reflects the fundamental value of the Canadian dollar. Most analysts would agree that the market value of 87 U.S. cents in 1991 overstated the underlying fundamental value of the dollar in that year. As a result, it was decided that a purchasing power parity value of the dollar of 76.4 cents based on a compensation cost index was a better estimate of the fundamental value. See *Estimating the Fundamental Value of the Canadian Dollar* (Revised Draft), by Peter Spiro, Macroeconomic Analysis and Policy Branch, Ontario Ministry of Treasury and Economics, December 1991. However, a number of different values of the exchange rate were tried and did not significantly alter the basic conclusions of this study which, of course, are focused on workforce skills and not wages.

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West, David.

A comparison of work force skills and wages between Ontario, Canada and selected states in the U.S.